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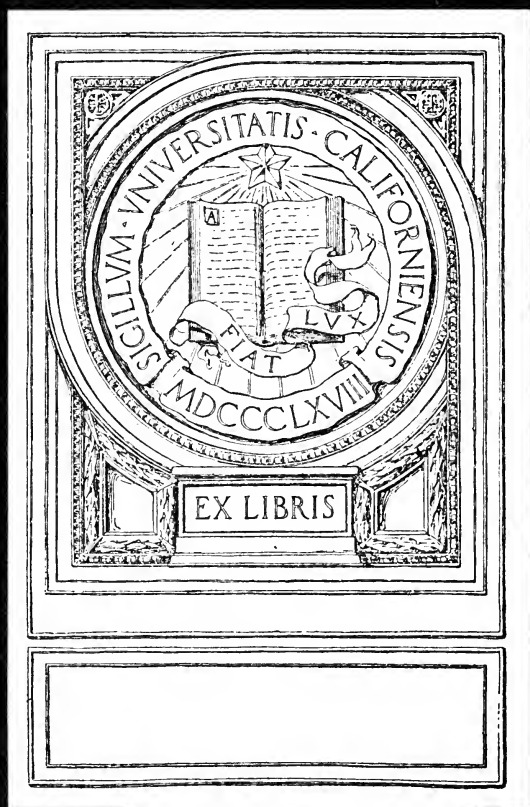
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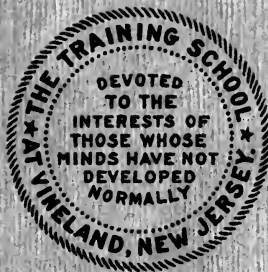


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PUBLICATIONS OF
THE TRAINING SCHOOL AT VINELAND NEW JERSEY

THE RESEARCH DEPARTMENT:
WHAT IT IS, WHAT IT IS DOING,
WHAT IT HOPES TO DO

BY
HENRY H. GODDARD



NO. 1--MAY 1914

THE
UNIVERSITY
OF CHICAGO

THE
DEPARTMENT OF RESEARCH
OF
THE TRAINING SCHOOL
AT VINELAND, NEW JERSEY

DEVOTED TO THE SCIENTIFIC STUDY OF

FEEBLE-MINDEDNESS

THE TRAINING SCHOOL,

VINELAND, NEW JERSEY

1914

HV 879
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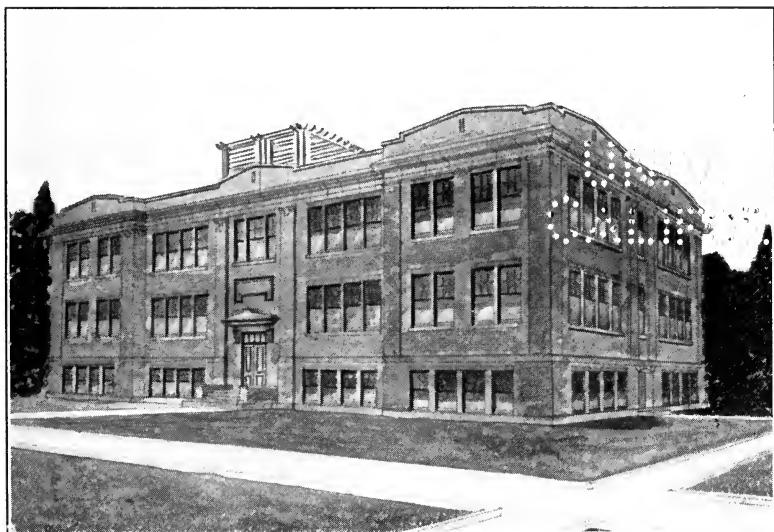
TO THE
MEMORIAL

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THE PROPOSED LABORATORY BUILDING WOULD
BE THE ONLY ONE OF ITS KIND IN THE WORLD. IT
IS TO BE NAMED FOR THE DONOR. IT CAN BE BUILT
FOR \$30,000.



THE LABORATORY STAFF



THE _____ LABORATORY
Proposed New Building

TO VNU
AMBOULAO

The Department of Research of The Training School At Vineland, N. J.

What it is. What it is Doing. What it Hopes to Do.

In 1888 the Training School at Vineland, N. J., was organized by S. Olin and Charles Garrison, under the auspices of an association known as the "New Jersey Home for the Education and Care of Feeble-Minded Children."

The objects of the school were primarily and originally to furnish asylum for mentally defective children, to give them such mental and manual training as they were capable of receiving, and to make them as comfortable and happy throughout life as possible.

The humanitarian motives which led to the organization of this school home for unfortunates found expression in 1906 in the organization of a research laboratory in connection with the Training School, where accurate, comprehensive, scientific study of feeble-mindedness gives promise of invaluable revelations as to the cause of these defects, their amelioration and the methods of prevention.

When we realize that there are on record upwards of 6,000 persons in the State of New Jersey alone who are markedly deficient, that the offspring of the mentally defective is most likely to be defective, and when we realize that probably a large percentage of crime and human suffering is due to the resulting irresponsibility, it is then that we recognize that the problem of human defectives is to-day the most important one before us from the moral, the social and the economic standpoint.

The Vineland Training School has recognized this fact and has made decided progress looking to new light upon a most depressing factor in human progress.

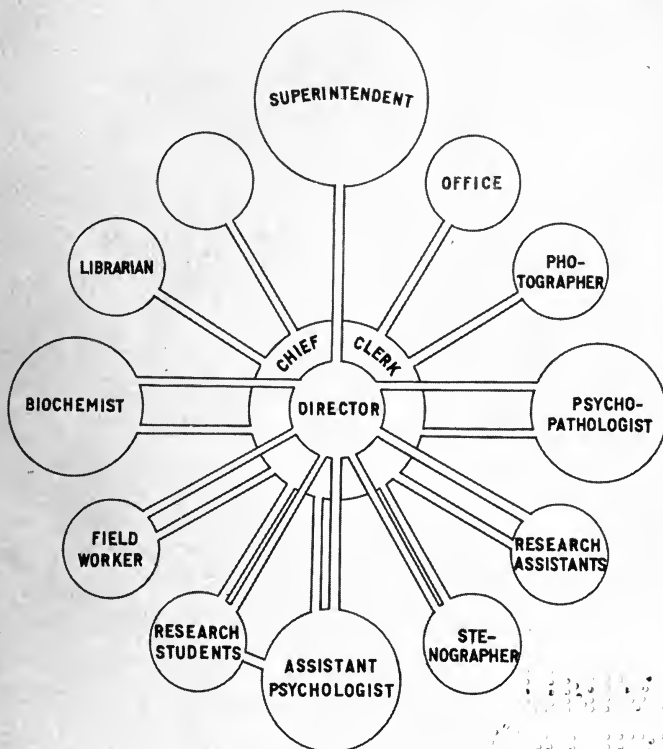
Years ago Earl Barnes said: "To me, Vineland is a human laboratory, a garden where unfortunate children are to be cared for, protected and loved, while they unconsciously whisper syllable by syllable the secrets of the soul's growth. It may very well be that the most ignorant shall teach us most."

September 15, 1906, the laboratory was opened and work begun. A year passed and an assistant was added. Perhaps we cannot do better in attempting to describe the beginnings of this laboratory than to quote from an article that we prepared after the laboratory had been in existence one year. This appeared in The Training School Supplement for December, 1907, and was entitled "The Research Work."

"In planning work to be carried on in the Research Department it seemed necessary to keep in mind two lines of usefulness: the one, a broad and far-reaching line of investigation, for which data should be carefully and wisely collected thru a long period, the results when obtained would be of surpassing value. The other line ought to be a series of short, direct, intensive studies that should have immediate interest and value to all who have at heart the welfare of the children in such institutions, to all who teach or train normal children and to the pure scientists.

Accordingly we have begun a system of 'case taking,' by which we expect to get complete data relative to the present condition, physical and mental, and the future progress of every child in the Institution. This will all be carefully kept, and in the event of death, if an autopsy is allowed, the post-mortem findings will be correlated with these facts and eventually conditions will become apparent whereby knowledge will take the place of ignorance, science will supersede guesswork.

RESPONSIBILITY CHART



DEPARTMENT OF RESEARCH , TRAINING SCHOOL , VINELAND , NEW JERSEY .

RESPONSIBILITY CHART

The Department is organized for efficiency.

Members of Staff are responsible to the Director for their scientific work and to the Chief Clerk for material equipment.

THE
END

We begin with the physical. We weigh and measure each child, note the rate of growth, the time of the appearance of each new physiological process, such as teeth, puberty, etc. We watch the child at his play, at his work, at rest. We note his reaction to the various situations in which he finds himself in this little world in which he lives—the Institution. In short, we attempt to get all that can be gotten from observation. We try to collect all his expressions, spoken, written and worked out.

Then we call experimental methods to our aid and, disturbing as little as possible his consciousness and personality, we attempt to limit the conditions, eliminate all but a few factors in the hope of thereby discovering the logical connection between his acts.

If the difficulty of the observational method lies in the interpretation of the facts observed, the difficulty with the experimental method is far greater. How to limit the environment for a limited mind and still leave a usable connection is indeed a problem. But by one means or another, after many trials, we discover a test that proves satisfactory and shows us some elementary truth about our child. In this way we gradually build up a picture of the child's personality and are able to compare it point by point with the average child of the world. When this plan shall have been perfected two great desiderata will have been attained—we shall know our child, what to expect of him, what he cannot do and how to minister unto him, and we shall have the facts which will enable us to say later, such and such powers and limitations go with such and such peculiarities of physical structure. We shall even be well on the road toward the great goal of all our work, the cause and prevention of the condition.

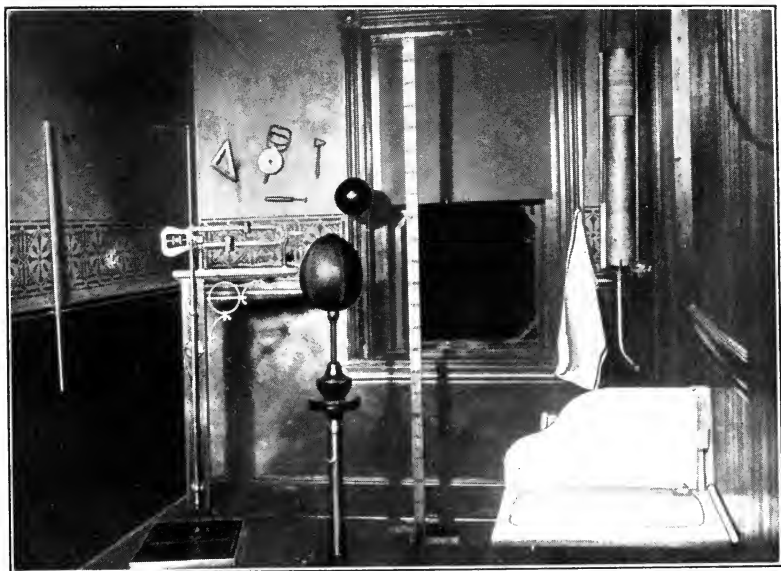
One may have the most intense scientific interest, but he cannot escape the humanitarian side. The bettering of these children and the helping and protecting society at large by thus taking out of general competition those who are unable to compete are thots which are ever present and which dominate one's action at all times. Where so many fertile fields are before one and rich reward is promised in so many directions a correct perspective is of great importance. Such perspective can only come from living with the problem.

The Future:

It has been asked how long this research work will be carried on? Until the cause of feeble-mindedness is known: until its prevention is understood: until all that can be learned from these special cases of mental development has been found out.

We believe that somebody will give us funds for a commodious and adequate laboratory building in which our work can be carried on with that accuracy and completeness which its importance demands. We believe that there is some one willing to endow liberally such a work so that it can be carried on with that perfect adjustment of means to ends which can only come when one is free from care as to where the money is coming from.

With the building and the endowment we shall have ample clerical force and be able to carry on extensive studies into the nature of the mental processes. We shall be able to employ an expert physiological chemist who will study the conditions of metabolism in these children, the way in which they are affected by various foods and medicines, the rate of assimilation and secretion, and the numerous problems that arise when we consider that we are dealing with an organism in which



ANTHROPOMETRIC ROOM



GENERAL OFFICE AND RECORD ROOM



chemical changes are constantly going on and that a slight variation in the nature of those changes may work marvelous results in the nervous system and consequently in the mind that is dependent upon it.

It is well known in medicine that caffeine stimulates the intellect. Who knows that some of the products of a slightly tho permanently deranged digestive system do not produce a chronic dullness of the intellect?

With an ample endowment we shall be able to send out a trained person to visit the homes of these children and by careful and clear explanation of the problem, and what we need to solve it, elicit facts that have been overlooked in answering the questions in the admission blanks—facts that will be of untold value in the solution of the problem of cause and prevention.”

Six years have passed, the growth of the laboratory has been phenomenal. Many of the things hinted at in the first account have been achieved. Then there was a Director with one assistant, now there is a Director with sixteen assistants.

What We Have Accomplished.

It was not long after the above record that we began looking into the heredity of our children, altho it was three years before our dream of a field worker came true. Since then we have learned many valuable things in regard to the causation of feeble-mindedness. The result of this investigation was partly set forth in “The Kallikak Family,” published in September, 1912, and will be more fully explained in a book now in press, entitled “Feeble-Mindedness, Its Causes and Consequences.”

About this time appeared the Binet-Simon Measuring Scale of Intelligence. While this did not at first appeal to us as very practical, we nevertheless felt compelled to give it a trial. The results were so surprising and so valuable that we immediately turned our attention in the direction of utilizing this valuable instrument to the fullest extent. The result is that we are able to classify our children much more accurately than was ever possible before, and on the basis of this classification are able to establish many principles of which we could never have dreamed.

The systematic collection of data referred to in the earlier article has continued regularly and has already furnished valuable material for studies of feeble-mindedness.

The idea hinted at, that we might be a clearing house for information that is contained in other institutions, was carried out in at least one study, namely, "The Height and Weight of Feeble-minded Children" (Journal of Nervous and Mental Diseases, vol. XXXIX, April, 1912). Most of the institutions in the United States contributed data on height and weight giving us the curve of growth based on the largest number of defective children ever studied—about 10,000.

Early in the history of the laboratory we discovered that there were persons, teachers and others, who were so desirous of knowing more about feeble-minded children that they were quite willing to come to The Training School to assist in the laboratory in return for what they could learn about the problem. While so working they received a home at the Institution. The research students, as we call them, have come to be an important factor in our work. For some time we have had more applicants than we could accommodate, either in the laboratory rooms or in the Institution as a home.



IN THE PATHOLOGICAL LABORATORY

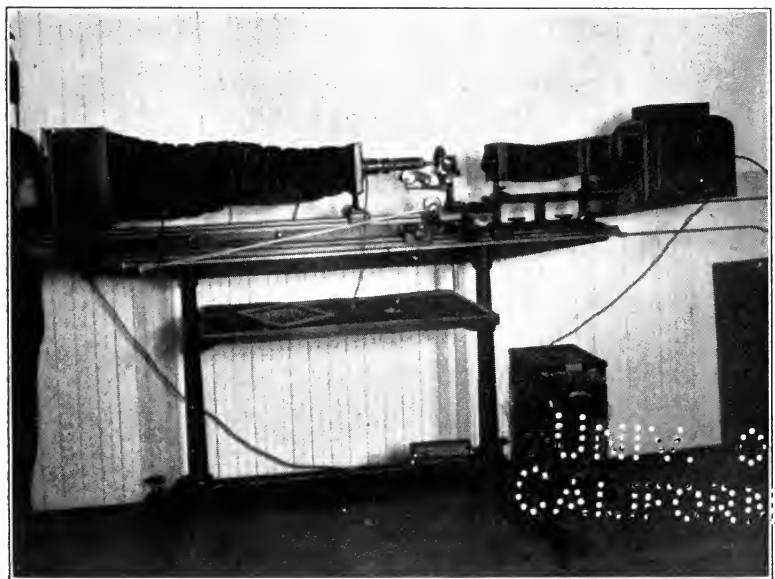


PHOTO-MICROGRAPHIC APPARATUS

**For making large photographs of microscopic objects
Gift of Prof. Charles Greene Rockwood**

2.4

The figure consists of a 4x4 grid of 16 small plots. Each plot shows a different spatial arrangement of black dots, representing the distribution of a specific species. The species are numbered 1 through 16. The distributions vary significantly, with some species showing a single dot in a specific location and others showing multiple dots in various patterns across the plot area.

The demand for these opportunities comes from college graduates and specialists, who desire to specialize in this work. We have, for example, had requests from a professor of education, a doctor of philosophy (in psychology), a principal of a Normal Training School, a well-trained woman from South Africa, who desired to go back to Africa to start work for defectives.

A year and a half ago, thru the munificence of Mr. Samuel Fels, we were able to make our first great extension—the bio-chemist and the pathologist referred to in that dream became realities, and at the same time an assistant psychologist was added.

The accompanying chart shows the organization of the laboratory at the present time.

A word should be said about the laboratory. The work was started in a small room on the second floor of what was known as the Industrial Building. Gradually as the work progressed and certain changes were made in the Industrial Shops of the Institution, one room after another was added to the laboratory until at the present time the work is carried on in ten rooms. Some of these are very small, merely large enough for a stenographer, a photographer or an examiner: indeed, we are everywhere very much crowded.

Before going further with our description of what is being accomplished and what we wish to accomplish, it may be well to set forth in a general way what we see before us.

In a word, our purpose is to find out all that can be found out about feeble-mindedness in all its forms and degrees, utilizing all of the methods that science has so far developed. We began with psychology, with the idea of ascertaining everything possible as to the way in which these minds, in their enfeeblement, manifest themselves. In this we aimed to use every method and

device known to the psychologist that it was possible to apply to the problem.

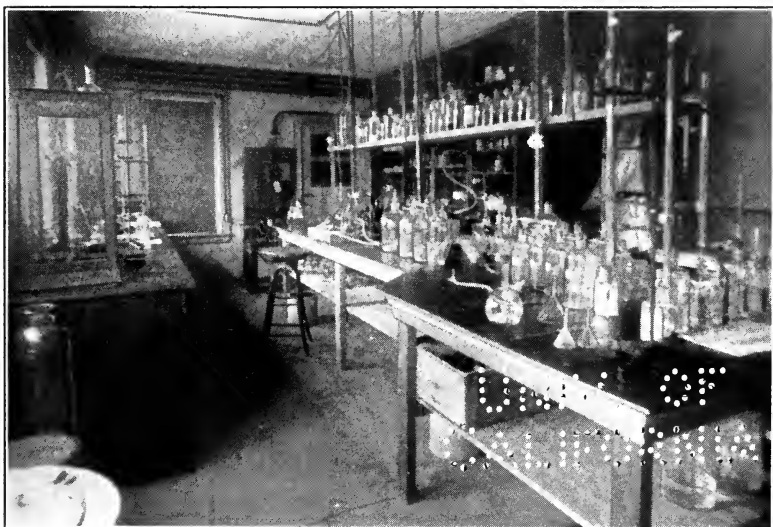
But we must study the child physically as well as mentally; not only because he is sometimes encumbered with actual diseases which ought to be eliminated before we can understand what is his natural mental condition, but also because the mental is so bound up with the physical that without the knowledge of the latter we can never thoroly understand the former. We must know his anatomical peculiarities and conditions. We must know his functional disturbances, if any, and his general physical condition. We want to know the chemical condition of his various tissues, of his blood and lymph, of his brain and heart, of his muscles and his ductless glands. We must know what he is eating and what he is doing with it, how the processes of metabolism go on, whether he is eliminating from his system the things that he ought to eliminate, or whether he is failing to eliminate these things and is eliminating that which ought to be assimilated.

Not only must we know all that may be learned by the methods of medicine, biology, psychology, chemistry, physiology, but we must know all that can be learned from an examination of the body after life is extinct. There are many conditions that cannot be examined during life, but are revealed in the body or its organs after death. More than this, we must know something about the child's parents and their ancestors, the environment in which he has lived, the diseases that he has had, and all other hereditary and environmental conditions which may have affected his present status. We shall illustrate these things more specifically in a later part of this paper.

It was pursuant to this ideal that we secured, as early as possible, a bio-chemist, a psycho-pathologist and an assistant psychologist. These men were hardly installed in their positions



A CORNER OF THE LIBRARY



IN THE BIO-CHEMICAL LABORATORY

until it became evident that each and all of them needed assistants. In each of these divisions there is much clerical work to be done, there is much routine work requiring intelligent persons, but not necessarily specialists. It became more and more evident that these experts should devote their time to the direction of the work of their division, and that a great deal of the actual routine should be carried on by helpers. We have fortunately secured some help, but far from all that we need. Each of these men could direct the work of several assistants, for whom there will be work enough for a long time to come.

Up to the present time the work in the new divisions has been largely a work of exploration in determining to what extent certain methods are applicable, and which of the numerous problems might most profitably be attacked immediately.

In the bio-chemical division, this preliminary survey has resulted in our settling upon work in metabolism, at present chiefly the examination of urines. In this work we have already discovered that certain classes of defectives have an unusually high tolerance for sugar (dextrose). Certain ones also are secreting an unusually small amount of calcium, while their phosphoric acid elimination is also abnormal. These matters while perhaps unintelligible to the layman are nevertheless of enormous importance in the whole problem, since they certainly show, whatever else they may indicate, that the defect in these children extends to their whole physiology and does not exist in the brain alone. To make the study complete this work must be controlled by knowing: first, exactly what these children eat, that is, what is taken into the system; secondly, what is being discharged by the organs of excretion. The former of these investigations is going on now, the latter will be taken up shortly.

In the psycho-pathological division an extensive psycho-physical examination is being made of each child. So far as

this has gone it has shown most interesting results which constitute valuable contributions to our knowledge of these individual cases. What we may term pure feeble-mindedness, that is simple arrest of development, is perhaps the exception. Usually the condition is complicated by various diseases or abnormal conditions, such as hemorrhages of the brain, tumors, or other disturbances, which interfere with various functions. The determination of what these conditions are by means of careful examinations of the reflexes, of the heart and lung action, of the blood and spinal fluid, becomes of the utmost importance.

The Wassermann test for syphilis is being carried out with the utmost scientific accuracy. The results so far indicate that probably from 90 to 95 per cent. of our children are free from syphilitic taint. This, when completed, will answer another very important question in connection with the causation of feeble-mindedness in these cases.

An intricate piece of work is being done on cranial measurements, which will make a very important contribution toward the much-mooted question as to the possible correlation between intelligence and cranial contents or cranial shape. No such examination has ever been carried on with so large a group of feeble-minded children, so well classified.

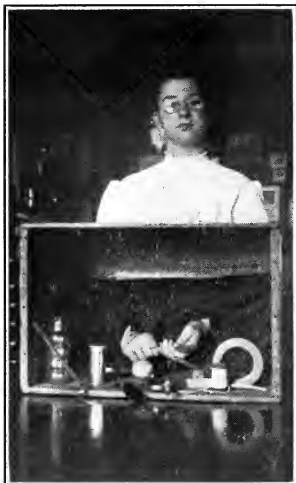
Possibly most important of all is the study being made on the brain tissues. Recent studies in neurology in the foremost laboratories of Europe have made it clear that the cortical surface of the brain is made up of five layers, each with characteristic nerve cells. In early life these cells migrate from one layer to the other and in the normal adult brain they come to have a very characteristic appearance. Studies of these brains that have been subjected to an arrest ought to show this migration and the formation of these layers in various stages of progress



FORM BOARD

One of the children doing The Form Board.

Tests intelligence and motor control.



STEREOAGNOSIS

Tests ability to recognize familiar objects by touch — This ability is lacking in certain forms of defect.



PRECISION TEST

Tests Muscular Coordination



MUSCULAR MEMORY TEST

Supposed to test capacity for skilled manual work

according to the time when the arrest has taken place.

On the purely psychological side our standardization of the Binet-Simon Scale for the American children has given a tremendous impulse to the question of backwardness and feeble-mindedness in public school children, and has given an accurate classification of their cases, which is fundamental for all special class work. This classification with our word *moron* has been well-nigh universally accepted. One seldom hears a backward child described in any other way than "His mental age is —," or "He tests —." The discovery of the moron is revolutionizing the social work of the country. Reformatories, prisons, juvenile courts, truant schools, are all finding many morons, with the result that their problems are being much simplified. Without the Vineland laboratory all this would have been delayed.

Our study has confirmed the view that these children, for the most part, have been arrested in their mental development, and it has been demonstrated that they do not from year to year raise that mental level.

We are further collecting data to show whether this arrest takes place suddenly or gradually. Whether it begins at birth or whether the child is perfectly normal in development for some years and then requires a few years to slow down before the arrest is complete. It seems probable that there are different types and that we shall determine ultimately for each type the time when it begins to slow down, the time thru which the slowing process continues, and the age at which the final arrest takes place.

We are also accumulating a mass of data which seems to make it certain that the normal mind develops by stages that cannot be forced, and that until it has reached a certain level it cannot master the work of that level. The importance of this for general pedagogy, the training and education of the normal

child, cannot be overestimated. It means that we must determine for every individual child the stage of his development; we must determine for every individual study, for every subject that we place before the child to learn, the degree of intelligence that is required for its mastery; and then we must put the two together. That is, we must present such subject-matter to the child at exactly the time when he is at that stage of development. As most intelligent educators already realize, we are without doubt frequently putting material for study before children a considerable time before they are ready for it. It is equally fatal to normal development to present the subject-matter too late, for then it is uninteresting and unappreciated.

We are also working on the problem of determining how close is the parallelism between these feeble-minded children of the various *mental* ages, and the normal children of corresponding ages. We describe a particular child as having the mentality of a normal child of eight years. Does that mean that he is precisely like a normal child of eight? One such study has been carried thru to successful completion which has determined that in the case of ability to discriminate lifted weights the feeble-minded child is practically the same as the normal child of the same mental age. Tho he be twenty years old or forty years, he has the same ability to discriminate weights as a normal child of eight, if his mental age is eight. Physically, of course, they are not the same. Habit enables the physically old persons to do many things that usually require a higher intelligence. These things are done mechanically and not by the application of judgment.

We are determining other methods than those employed by Binet in his Measuring Scale for ascertaining the mental development of children. In this connection we have standardized the Form Board, originally designed and used by Seguin, later modi-



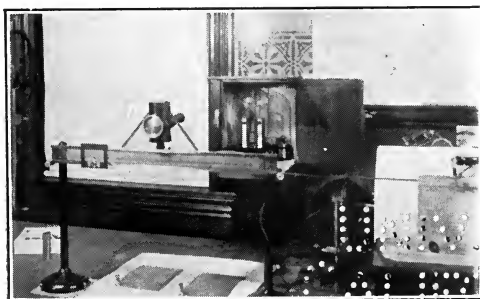
CHRONOSCOPE

Measures the time it takes to think. Records time to one thousandth of a second.



NEEDLE THREADING

Test of motor control



PSYCHOMETER

Records the presence and measures the strength of an emotion.

fied by Thorndike and Norsworthy and finally adapted in this laboratory to the particular needs of feeble-minded children. We have also devised and standardized a measure of adaptability in what we call our Adaptation Board, which tests the child's ability to adapt himself to changed conditions when those changes are very slight and of such a simple character that they can be measured.

In the routine work we are collecting a mass of information on each child as to what he can do, how he learns, how he expresses himself, how he behaves, how he reacts to various situations and stimuli, all of which will ultimately be correlated with his metabolism as found by the bio-chemist, with his physical functioning as found by the pathologist, and with the structure of his brain as may be found if he dies and an autopsy is held.

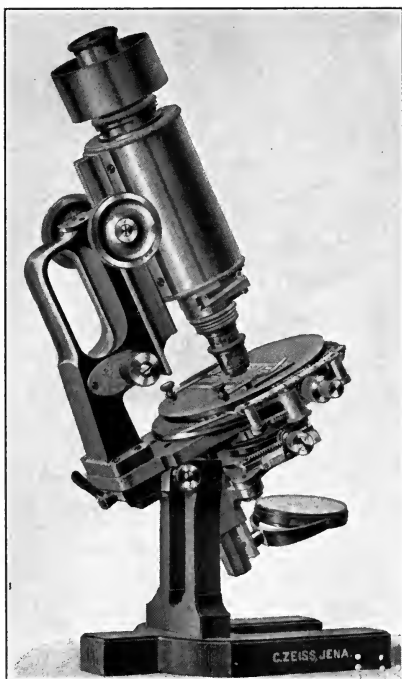
The foregoing will indicate something of the present activities and accomplishments of the laboratory.

The Future of the Work.

In such highly specialized work as that of the laboratory study of feeble-minded persons, and in such an entirely new field, it is difficult, not to say impossible, for the person unacquainted with such matters to understand what are the possibilities. In order to make clear to any reader that there are possibilities, and to state as accurately as possible what these possibilities are in the order of their promise, by relating: first, those results that are imminent, those that are in sight, that are as sure as any scientific work; secondly, those that have a very high degree of probability; and, lastly, those that are suggested by what we have already accomplished, even to the extent of mentioning those that may seem fanciful and even chimerical, will be the purpose of the rest of this article.

No one will need to be persuaded that we have in the case of feeble-minded children a field where experimentation is not simply justified but literally demanded. In these days of achievement in medical science and therapeutics, the *last resort* argument has come to be final and conclusive. There is scarcely any operation or medical treatment that may not be tried upon a person of whom it is said, "there is only this chance; he cannot live otherwise, and there is a faint possibility that such a treatment may be successful." Feeble-mindedness is at present a hopeless condition. No one knows of any method of cure, and there is no recognized "right method" of treatment. It is as tho these children came to us on bended knee and with outstretched arms pleading, "We are not like other people, we want to be, help us. Do anything, try anything, but if possible help us!" Of course, the case is not analogous to one in which a person is suffering and demands treatment. These children are not suffering, they are not conscious of their defect, nevertheless their very condition does cry out for help. And while we can not make experiments that will cause pain or endanger their lives, or still worse, have the possibility of bringing upon them a worse condition as long as they may live, there are nevertheless a vast number of experiments that can be tried without any danger of producing bad results.

The first thing that we may consider is diet. It has been said that man is "what he eats and what he does with it." Most people learn after a great deal of unscientific experimenting that there are certain foods that are injurious to them, there are others that are most valuable to them, and still others that are either useless or injurious under certain conditions. It is an old proverb that "what is one's meat is another's poison." The reason for this must be, in the last analysis, that they do not do the right thing with the food that they take—that their metabolic



COMPOUND MICROSCOPE

A complete microscope, provided with a mechanical stage and micrometers by which the length, breadth and thickness of microscopic objects (e. g. brain cells) can be measured to the ten thousandth part of an inch.

Gift of Prof. Charles Greene Rockwood, Prof. Emeritus in Princeton University, 1912.

processes are not working normally. This again may run back to their inheritance, to the character of the organism with which they start life. In the normal healthy man the mouth is alkaline, the stomach is acid. If a person were born with these conditions reversed, who can imagine what would be the consequences! We know that just a little disturbance of the normal condition of these organs is productive of disease and discomfort. Suppose that for some cause a child is born with a chronic abnormality along some of these lines, then the substances that he normally eats, that are normally considered food, may be to him productive only of injury. It is easy to imagine that there might be conditions where this would not manifest itself as it usually does in pain and discomfort and disease, but would show itself in a peculiar physical and nervous condition, which, affecting the mentality, would produce a feeble-minded individual. This shows that we must first discover what is the actual condition of the organism that we are studying. Has the feeble-minded person a skeleton, a musculature, a blood, a system of digestive organs, a vascular system, a series of ductless glands, all of which are composed of normal chemical constituents, so that he is what we may call a normal organism? If so, and we feed such an organism the usual food and the wrong results are obtained, then it is a question of why these results. Logically, then, we should first ascertain the primary condition of all parts of the human body and its functions. Practically we cannot do this. The three things have to go along together. We must find out, as we can, what is the condition of his bodily organs, then we must know what kind of food he is taking in, and we must find out what is being done with that food, and we may hope that, knowing two of the unknown quantities, we may find the third. Sometimes it will be one pair that is known and sometimes another.

To analyze the food that is taken and then the excretions and the blood and secretions must reveal to us the answers to a great many of these questions. We shall get our foundation data thru a chemical analysis of the various organs and tissues and the secretions.

Consider the series of so-called ductless glands or glands of internal secretion. It has been demonstrated that these glands have a great deal to do with the normal functioning of the human body, including its growth and development. It is further believed that they do not act independently, each having its own independent work to do, so that if any particular gland is injured or does not function some one thing is thus interfered with; but, on the other hand, it is believed that they are interacting, that the secretion of one gland is somehow important for the activity of another gland. The number of possible combinations here is very great. What may result from the interruption of the functioning of any one of these glands it is impossible to predict. In this one subject alone there are possibilities enough to account for all the kinds of feeble-mindedness that are known. The man who would say, "I will study the ductless glands to find the cause of feeble-mindedness, if I can restore them to natural functioning I will cure all feeble-mindedness," might be laughed at, but his theory could not be proved to be ridiculous. On the contrary, he could make one very telling argument, namely, the relation of the thyroid gland to a condition of defect known as Cretinism.

Cretinism is known to be due to a lack of functioning of the thyroid, either because it is absent or because it is hypertrophied. We are assured upon good authority that if thyroid is administered early enough and regularly such a child may be made normal both in physical growth and in mentality. Even when administred late the effect of this treatment is often little less than marvelous. Furthermore, there is the other type of feeble-



THE ROMBERG TEST

One of the children being tested for steadiness

mindfulness, the Mongolian, which so closely resembles the Cretin (the two being often confused) that it has been suggested to every thoughtful student of the subject that this must also be the result of a glandular defect. It is evidently not the thyroid, because in the first place, the thyroid is present and apparently normal in the case of the Mongolian; and secondly, the administration of thyroid extract—as has been proved in several prolonged experiments—has no effect upon this type. But it may be some of the other glands that are involved and, if so, we may some day find out which they are and be able to come as near curing the Mongolian type as we do the Cretin.

We can go still further. We have already demonstrated in this laboratory that the Mongolian type has, as a rule, a very high sugar tolerance, that is to say, these children show no trace of sugar in the urine when fed two or three times as much as the normal individual can assimilate. What becomes of it has not yet been determined, but the present view is that an unusually high sugar tolerance is indicative of some derangement of the ductless gland system. Following this line of argument, while it is not a thing that the scientist will commit himself to, because it is a little too far in the future, it is no more strange or startling than many a recent achievement in medicine or biology for one to say that the time may come when we may by examining the urine or the blood or the spinal fluid of a prospective mother, determine that she is in a condition which is sure to result in the birth of a Mongolian child. We may then proceed to give her such treatment as will change the condition and correct the situation with the result that instead of a Mongolian, a normal child will be born. When we consider that the Mongolian type of imbecility is one that appears in the best of families and, so far as we know, is liable to occur in any family, and when we realize that because it does occur in families of higher social and intellectual

attainments, it is perhaps the cause of more sorrow than any other form of feeble-mindedness, we can see that such an achievement would repay the expenditure of thousands, yes, millions of dollars, and years of study.

The nervous system plays an enormous part in this whole problem. It is, of course, popularly supposed to play the sole role. A child is feeble-minded. It is *supposed* that his brain is out of order. However, we now know, as already implied, that other organs, perhaps nearly all the organs and functions of the body are more or less involved, but the brain and nervous system is interwoven with the whole problem. It is both affected by these other functions, secretions, and in turn affects them. The very fundamental problem is, what is the condition of the brain tissue? We must chemically analyze the brain of mentally defective children. Perhaps also we must analyze its different parts. It is a very old notion, that fish is brain food, and that to eat much fish feeds and develops the brain. While in that simple and crude form there is no scientific foundation for the statement, yet it will serve for an illustration. It is true that phosphorus in the form of phosphoric acid is somehow very essential to proper metabolism. Fish contains phosphorus. Suppose, for the sake of illustration, that the brain could not function normally without phosphorus and that there is no other way to get it than from eating fish. Now a child who has never eaten fish could never have a normal brain, would be feeble-minded. While, as is said, there is no foundation in fact for this (the problem is by no means so simple), yet we may from this illustration imagine how it is possible that the brain may have a slightly abnormal chemical composition, which may be due to the fact that the diet is not of the right kind; or because of the abnormality of some other organs even tho the proper food is taken into the stomach it is not properly received, that is to say, there are not the proper ingredients

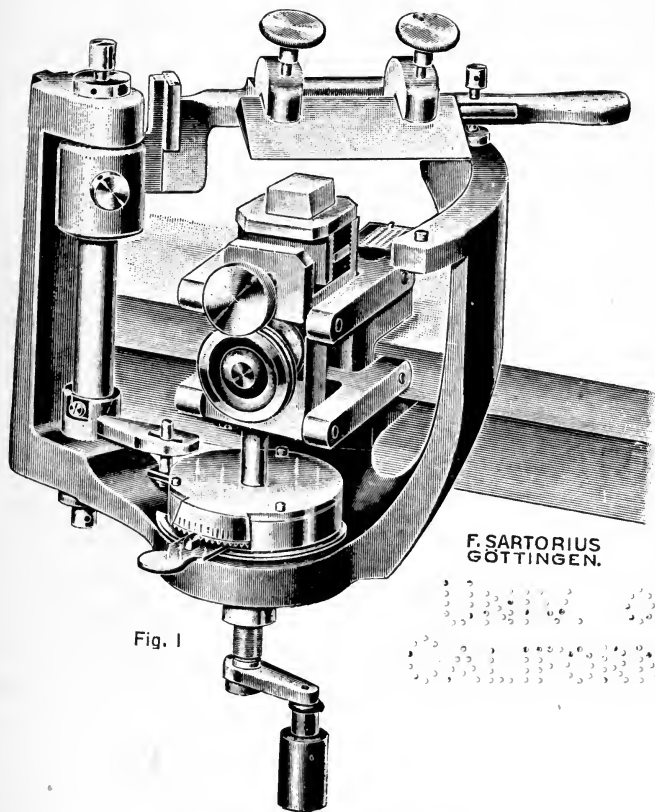


Fig. 1

SARTORIUS MICROTOME

For cutting microscopic sections of small organs or parts of organs, so they can be studied with the microscope.

Gift of Prof. Charles Greene Rockwood.

there to transform it into the right condition whereby the brain can become nourished by it.

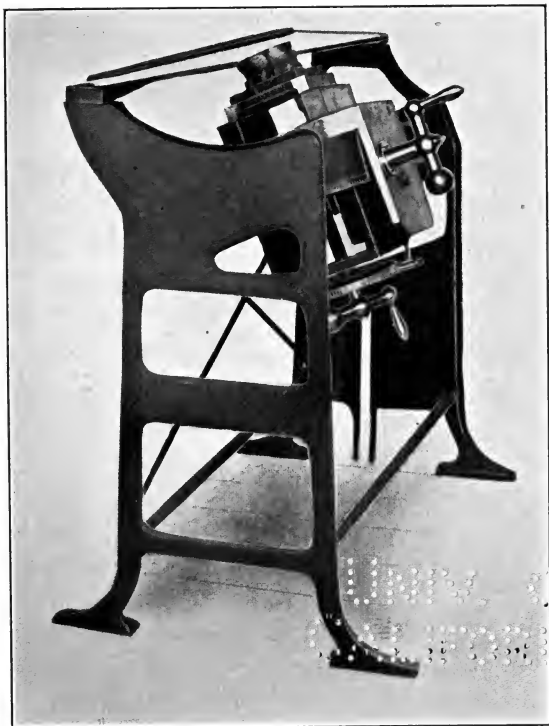
All these problems must be studied. The solution of each and every one of them is fraught with tremendous and important influence upon the whole problem. It is impossible to discuss all of these lines along which bio-chemistry will contribute to our knowledge and solution of this problem. But as has been said, all the organs must be analyzed and the secretions and the blood must be analyzed. What is known as the problem of the residual nitrogen must be studied, even the bones and muscles, the perspiration, perhaps even the hair and nails. All of this requires an immense amount of time and equipment. Our bio-chemist will not live long enough to study all of these problems if he works alone, but he could easily direct the work of from six to twelve trained assistants and results could be obtained in a few years that would be of such far-reaching importance that the imagination fails to compass it.

Turning to the psycho-pathologist, we have another great field equal in the importance and in the significance of its results. The histological study of the brains of the feeble-minded will ultimately tell us the location of various difficulties and enable us to form a picture of the condition which underlies the mental state. The blood and the spinal fluid must be studied from a somewhat different angle from that employed by the bio-chemist. The relation of the various diseases to feeble-mindedness must be determined. By correlation with the mental condition as determined by psychological experiments, we must ultimately be able to diagnose these cases with great accuracy. Just as now in insanity the psychiatrist makes certain physical and mental examinations and says there in the brain is a blood clot here, or a hemorrhage there, so in cases of feeble-mindedness we must ultimately determine the particular character of the mental

condition and thru the knowledge which the histology of the brain will give us, be able to say that the difficulty here is that this or that tract of brain fibres is not functioning. Perhaps these fibres are not functioning because of a blood clot which can be dissolved, perhaps because of a pressure which can be reduced, perhaps because of a condition which some drug may relieve. We are not holding out hope that any considerable percentage of feeble-mindedness will be cured by any such methods, but until we know what is the exact condition we cannot say what may or may not be accomplished. The determination of the actual condition that the individual is in, the complication of the feeble-mindedness by the presence of other diseases, the cause or causes of these diseases and of the feeble-mindedness, all will contribute enormously to an understanding of what is to be done to ameliorate the condition in the individual, and, still more important, what may be done in the future to prevent the recurrence of such instances.

Here again, all of this work is slow and tedious and no one man can live long enough to solve all of these problems, but here, also, the psycho-pathologist could direct the work of a group of people, each working on a special problem, and in a short time the results would be of enormous value.

The psychological division is no exception to what we have already seen as to the possibilities of investigation. Hardly any two cases of feeble-mindedness manifest themselves in the same way mentally. The psychologist has his problem of determining the peculiar mental content of each mind. It is not too much to suppose, indeed there are already indications, that a case of hereditary feeble-mindedness differs in its mental content from a case of the same grade which is due to a disease such as meningitis, or due to an accident such as a hemorrhage. We shall ultimately get our knowledge of the mentality of these cases to such a



LARGE MICROTOME

**For cutting sections of large organs, especially the brain.
Donated to the Laboratory by the inventor. (1-10 natural size)**

25

[illegible]

point that thru correlation with the work of the other divisions already described, we shall be able from a mental examination to decide with much accuracy upon the probable cause of the condition.

Everyone is very much at sea at present, as to what is the best kind of training for these defectives. It is undoubtedly true that time, money and energy are being wasted in our attempts to accomplish the impossible. The psychological study of these cases must reveal fundamental facts which will be of value in this direction. We ought to be able to find out enough about the mental condition of the child to make a very accurate prognosis as to the kind of training that is best suited to him, or the lines along which he is most likely to achieve whatever success he is capable of. In other words, we have a vocational guidance for these cases which is most important. Here, again, a number of psychologists might be at work on these problems.

Thru the correlation of the findings of these different lines of work our final pictures of the condition, the cause, the treatment or possible cure of feeble-mindedness, must eventually be made.

I have not attempted in the foregoing to give any exhaustive statement of the problems that should be worked out in these different divisions, or of the results that are likely to be obtained. To do so would be to write more than one volume of many pages. I have only tried to indicate that there are things to be done and there are great possibilities of profitable results.

To sum up one might say that the work runs along three lines: a study of causes, of conditions, and of what we may call cure, including prevention, elimination, and amelioration. There are also three ways of solving the problems, or rather perhaps three parts to the problem.

First: A determination and an elimination of the non-

important conditions; the securing of negative results; the removing from the situation those things which are not important, but which as yet we do not know enough to discard.

Second: A study of abnormality, its causes and its relations to normal conditions.

Third: The possibility of changing for the better the conditions that are found: (a) by the study of the effect of various substances, such as drugs, poisons of disease, ferments, the products of metabolism, etc.; (b) by a study of conditions as they are found in cases due to meningitis, to fevers and other diseases, to epilepsy, and the condition in the hereditary cases; (c) to prevent the development of such cases as Mongolianism, Cretinism, and the like.

Many analogies might be drawn if space permitted to show the possible condition of the feeble-minded. Almost any person knows what it is to be in such a state of fatigue that he cannot think; possibly the feeble-minded are in a condition somewhat analogous to a chronic state of fatigue. We know the effect of malnutrition upon bodily development and upon what we call brightness; possibly the feeble-minded are in a chronic state of malnutrition, due as already indicated, to the faulty metabolism or the faulty condition of the organism at the start, or the wrong kind of food. We all know the condition of apathy and lack of animation following a severe illness when the body has been filled with foreign substances, poisons, toxins of various kinds; perhaps the feeble-minded are in a chronic state of toxemia. An extensive study of the problem cannot fail to reveal much along these lines.

No reader will need to be persuaded that the accomplishment of all or even of a part of this requires great facilities. In the first place it needs men highly trained and capable, conscientious, enthusiastic and interested in humanity and in their special prob-



PHOTOGRAPH OF A SECTION OF BRAIN

About one thousandth of an inch thick: cut with the microtome shown in the previous picture. (About 2-3 natural size)

2.

lems; we have already made a splendid start in this direction thanks to the generosity of Mr. Samuel S. Fels, whose unusual appreciation of the value of scientific research has prompted him to contribute largely to this work. But we need a laboratory building in which all of these departments can have adequate space for development; where they can all be correlated under one roof, and all may work together. Apparatus and materials are also needed.

We have carefully prepared plans for a laboratory building which would be ample and satisfactory. This would cost about \$30,000.00. The heating, lighting and furnishing would probably cost \$5,000 more. A building to house laboratory workers, \$3,000. This would be largely for the use of research students. At the present time we are unable to avail ourselves of more than one or two of these for lack of living rooms for them.

The situation is best appreciated by considering the fact that for the year just closing our expenses have been \$18,500. For the coming year, if we do what seems imperative, the budget should be \$25,000.

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- LOLA BARNARD Teacher of Special Class—Cleveland, Ohio.
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HENRY H. GODDARD

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